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geneous state of the temperate flora as itself a resulting, not an original condition. Still less, therefore, could he coincide with Professor Agassiz, in regarding the actually present distribution, with all its dislocations, as a primitive state. Whether a much larger number of species than now were ever common to Japan and to New England, and whether these at any one time inhabited the whole intermediate ground, appeared to him uncertain, and was unnecessary to suppose; but he had no idea that *recent* migration had anything to do in accounting for the present existence of the same species in such widely separated stations.

Four hundred and fifty-ninth meeting.

January 26, 1859. — STATED MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters from the Royal Belgian Academy, Brussels, acknowledging the reception of publications from the American Academy, and presenting its own recent Memoirs. Also, a letter from the President of the Royal Bavarian Academy of Sciences, Munich, announcing the intended celebration of the centennial anniversary of the foundation of that society on the 28th of March ensuing, and inviting the participation of the American Academy.

On motion of Mr. Winthrop, seconded by Professor Felton, Dr. Charles Beck, being now in Europe, was appointed to represent this Academy upon that occasion.

Professor John Lindley was elected a Foreign Honorary Member, in Class II. Section 2 (Botany), to fill the vacancy made by the decease of the late Robert Brown.

Sir William E. Logan, Director of the Geological Survey of Canada, was elected an Associate Fellow, in Class II. Section 1 (Geology, &c.).

William Watson Goodwin, Ph. D., of Cambridge, was chosen a Resident Fellow, in Class III. Section 2 (Philology, &c.).

On motion of Mr. Henck, a special appropriation of two hundred dollars was made, for the purchase by the Library Committee of additional works upon mathematics, technology, and engineering.

On motion of Professor Agassiz, special meetings for scientific discussion were voted to be held, at the hall of the Academy, on the fourth Tuesday of February, March, and April ensuing.

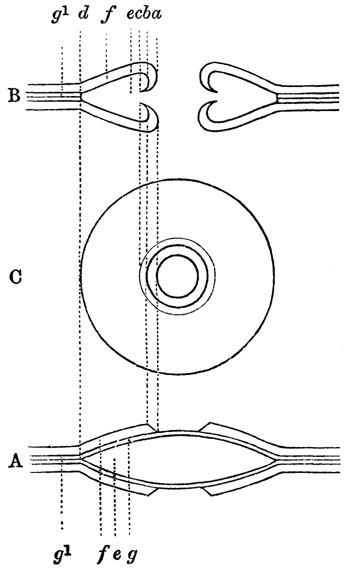
Professor Peirce made a further communication upon the tail of Comets, especially of Donati's Comet.

Mr. H. J. Clark read the following paper upon the use of the microscope, as recently improved, in the investigation of the minute organization of living bodies: —

"I was incited to bring together my thoughts and experiences upon this subject, by discovering, three or four months ago, a novel feature in the so-called glandular dots of the wood of our common White Pine (*Pinus Strobus*, Linn.).

"A dot of this kind is usually represented by a circle (Fig. 1, C, *d*), in the centre of which is a single or double ring (*a*, *b*), which has about one third the diameter of the first (*d*). The outer circle (*d*) is described as the boundary of a lenticular space (A, *e*) between two *contiguous cells*, and the inner double circle (C, *a*, *b*) as the outskirts of a perforation (A, *a b*) in the deposit layer (*f*) of the cell. The double circle arises, as is said, from the fact that the perforation has the shape of an extremely short truncate cone, which, when viewed endwise, presents to the eye its two circular ends concentrically; the broader end, which is always next the interior of the cell, corresponding to the outer (*b*), and the narrower end to the

Fig. 1.



inner circle (*a*). Thus are these dots described and illustrated, by Mohl, Schleiden, and Schacht, as seen in the common European Pine (*Pinus sylvestris*), and thus did they always appear to me, not only in that species, but also when I observed them in *Pinus Strobus*, except with this difference, that the perforation was bounded by an exceedingly faint third circle (C, *c*), whose relations I could not comprehend, nor was I able to reconcile its presence with the theory in regard to the nature of the perforation. I therefore left it, doubtingly supposing it to be some optical illusion. The microscope which I used, and which I have been in the habit of using up to within the last six months, is an Oberhaeuser's, made for Professor Agassiz some years ago; and yet at this very day I find it as good, with perhaps a single exception, as any now made in Germany, and therefore just as trustworthy in the investigation of the glandular dots of the Pine.*

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* It may not be uninteresting to state here, that the first great microscope made in Germany was constructed in 1829 by Fraunhofer, for Professor Agassiz. This microscope was represented in a copper-plate engraving, and described by Döllinger in the Memoirs of the Munich Academy for 1829, or 1830. In January, 1831, Agassiz went to Paris, and having given unlimited orders to Oberhaeuser for the best microscope that could be furnished, according to the knowledge of those times, he received from that maker, in 1832, an instrument which has not been surpassed in all Germany to this very day; at least, I have never seen any work from the hands of the best observers there, whether zoölogists, histologists, physiologists, or botanists, which could not have been accomplished just as well by this microscope. There may be one exception to this of a very recent date, but I am acquainted with the instrument only through report. With this masterpiece of Oberhaeuser Agassiz has gone on to this time, doing his great work with remarkable success, as all the world knows. Of late years it has become evident to Agassiz that his instrument was not equal to the demands which the progress of his researches put upon it; that there was something beyond its reach, of which he now and then could get a glimpse, just enough to warrant him in the belief that the study of the intimate structure of organized bodies had hardly begun.

So long ago as 1852 he had opportunities to see the workings of an instrument of the English pattern, made by Spencer; and although it was known as a rival, if not superior to the Transatlantic microscopes, he did not become convinced that it came up to his requirements.

Two or three years later I had the pleasure of bringing to his notice the results of some of my own researches upon the value of recently constructed objectives of English make. This gave him renewed hope, and, having heard of Spencer's continued rivalship and growing superiority, he determined to test his skill to the utmost. He therefore, in 1857, requested me to visit Canastota, in order to consult Spencer, and advise him as to the nature of the work for which we wished to use

"For the last six months I have used one of the most recently improved microscopes, made by Mr. Charles A. Spencer of Canastota, N. Y.; and with this, between three and four months ago, I again attempted to solve the mystery of the glandular dots. This I did with the most complete success.

"When the focus was brought to bear upon the inner surface of the dot, the innermost ring (B, C, *a*) of the perforation appeared first; a little deeper, the next outer one (*b*) came into view, whilst the innermost (*a*) disappeared; and still deeper the last (*b*) passed from my sight, and the faint ring (*c*) of my old observations came out sharply and clearly, as an exterior circle to the two others.

"I also observed, when passing from the innermost circle (*a*) to the outermost (*c*), that the widening was gradual; and so, too, did it appear in the transit from the second ring (*b*) to the outermost (*c*). This gave me the clew to the whole structure. I saw that these rings were not the expression of a simple perforation, but of the outwardly curled edge of this aperture, shaped in such a way as to form a sort of trumpet mouth.

"Although I would not trust to a transverse section alone, yet I found that it confirmed me in my views as explained above. The figures which I have given, — namely, a transverse section (B) with dotted lines projected upon a face view (C) of the dot, — I think will suffice to illustrate what I believe to be the true relations of these rings.

"Now, why was it that the Oberhaeuser instrument would not divulge these relations, when the microscope of Spencer succeeded so satisfactorily? This I will explain by showing the difference be-

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his instruments. This consultation resulted in the conclusion that we must have three sets of objectives; — one, with the extremely flat field; a second of the like kind, but so put together as to allow working with it plunged in water; and the third with a depthing focus extending as far as possible beyond that of the ordinary kind, for the purpose of viewing objects as a whole, in order to ascertain the relations of their different parts. And now Spencer is devoting those extraordinary abilities, which show him to be a man of genius, to the construction of a microscope which shall embody not only the optical excellences of the different systems of lenses required for the various modes of investigation, but also those conveniences of mounting which the long use of that instrument has taught us, to facilitate the researches upon the living being in its normal condition, in its element, that we may be no longer compelled to represent the tortured figures of a crushed body or dismembered organism.

tween the objectives of the two microscopes. I will compare the action of the objective of Oberhaeuser to the manner in which a plano-convex lens treats the rays of light which pass through it, from any object. Those rays which pass near its axis are brought to a focus at the farthermost possible point from the lens, whilst the rays which pass through the periphery are converged at a much nearer point, and between the axis and periphery there are all degrees of convergence. The difference between the farthermost and nearest points of convergence may represent the distance or depth through which the objective takes cognizance of things, and will account for the fact that I saw all the rings of the Pine-dot at one time.

"The action of the objective of Spencer's microscope may be compared to that of a parabolic lens, which converges all the rays of light to one absolute plane, and therefore forms what is called a *flat field.*

"Now out of this field, either above or below its horizon, it is not possible to see anything, and on this account, when the innermost ring (B, C, *a*) of the dot was in view, the others were not to be observed; and when the field was lowered to the second ring (*b*), the innermost one (*a*), being above the horizon of the field, was invisible; and, again, when the outermost and lowest ring (*c*) was reached, the middle one (*b*) also vanished.

"Were this outermost ring as distinct as the others, it might have been possible to detect its relations by means of the Oberhaeuser; but since it is the exceedingly delicate, reverted edge of the perforation, the narrow aperture of this ordinary objective does not admit sufficiently oblique rays to define it, to say nothing of its being confused with the other rings which are in view at the same time.

"I would here remark, that this peculiar structure is most frequently to be observed in old wood, when the cell-wall (B, g^1) has also become perforated, and even has retreated from the deposit layer as far back as the edge of the lenticular interspace. In young wood the perforation corresponds with the figures usually given. I have used this discovery, not only to show how little may be understood of the structure of a familiar and much treated of body, but also as a preliminary illustration of the exceeding value of a flat field and a wide angle of aperture in microscopic investigations.

"But this is not the first example which has occurred to me. As far back as a year ago last summer I visited Mr. Spencer, and spent several days with him in testing his objectives with the tissues of every creature which we could find. I shall never forget the astonishment and delight with which I occupied day after day, plunged into the hitherto unknown depths of organic life. I say this after having tested from time to time some of the best English microscopes which have been made since the 'Great Exhibition,' and therefore am not to be supposed to have made so great a leap as if from an Oberhaeuser to a Spencer. Since that visit, and another one also, made last summer, when I obtained one of Mr. Spencer's quarter-inch objectives, with an angular aperture of one hundred and forty-five degrees, I have from time to time made particular efforts to test the value of the flat field and wide angle in the study of organized bodies. The results of my investigations at Canastota, and also since my return, I have embodied in this paper.

"One of the most valuable properties of the flat field is, that it enables one to study an isolated cell, in a manner totally unexpected to me, making it possible to obtain a section of such a body at any horizon, as if it were actually cut across. As I have said before, the flat field ignores everything above and below its horizon, and therefore, if it is brought on a level with the equator of a spherical cell, the largest possible circle is obtained, and the actual thickness of the wall becomes apparent; and if it is raised or lowered, the circle grows smaller and the wall seems thicker, because of the obliquity of the section, and yet appears as distinct as the one at the equator. This may go on until the field approaches very closely to the upper or lower side, and then the inner surface of the cell appears. In an ordinary microscope, the far-reaching power of the objective utterly precludes the possibility of such a process of investigation.

"The relations of the Purkinjean vesicle to the yolk, and the number and position of the Wagnerian vesicles, have always been difficult subjects to work out with the ordinary microscope. If the Wagnerian vesicle was situated at the upper or lower side of the Purkinjean vesicle, it has often been next to impossible to tell whether it might be really within the latter, or was one of the very similar yolk-cells outside. There are many other instances of the like kind too numerous to mention. All this difficulty I have seen obviated by the decided, section-like precision of the flat field, which at once revealed to the eye the exact and relative level of every vesicle or yolk-cell.

"I was most forcibly reminded, not long ago, of the value of the wide angle of aperture, and the accompanying great amount of light, upon trying Spencer's objective upon the stem of a well-known Hydroid, the *Clava leptostyla*, Ag. In the manuscript of the forthcoming volume of Professor Agassiz's "Contributions to the Natural History of the United States of America," the outer wall of this Hydroid, and of several others, I may say in passing, had been described as a structureless membrane; but what was my surprise, in my last attempt, to find that this wall was composed of a layer of polygonal cells, as distinct as any in the other parts of the animal, and even readily discernible in the more opaque parts, where the stem appeared like a simple black surface under the ordinary microscope.

"In regard to the usually estimated worth of wide angles of aperture, I would say, that, from numerous experiments upon living tissues, objectives having this property are valuable, not so much because they can admit extremely oblique one-sided rays, but because they allow rays to enter from all sides at a very wide angle to the axis. One-sided oblique rays throw the shadow, in a great measure, beyond any particular cell upon its neighbor, and this produces distortion; whereas when the rays converge at a wide angle, each cell becomes strongly marked at its periphery by a dark, broad shade. A moderately oblique, one-sided light, hardly twenty degrees from the axis of the objective, always appeared to be the most frequently serviceable. I was surprised one day to find that the hitherto faintly visible circulation in the cells of Spirogyra was rendered, by such a light, very distinct, and the granules borne along in the current appeared like little specks with a very sharp, thick, black outline.

"At first thought, there would appear to be an insuperable objection to the wide angle of such objectives, and that is the shortness of the working distance, which will not allow one to take anything more than a superficial view of a body, even of moderate thickness. But this objection has not the least force, and, on the contrary, the more nearly absolutely flat the field is, especially in the lower powers, such as the $\frac{1}{2}$, $\frac{2}{3}$, and 1 inch, the better will they bear the use of the higher eye-pieces. This is not a speculative suggestion, for I have been told by Mr. Spencer, that he has been able to see the lines upon

Pleurosigma angulata with a one-inch objective of his make. Now nothing but the enormously wide angle and the remarkably flat field which he has introduced in such a low power, could enable one to solve such a finely marked Diatom. Only a few years ago this little unicellular plant was a test object for the highest powers of the best microscopes.

"But if this image, or the image of any minute body, is to be magnified to any extent which may be required, by the use of the higher eye-pieces, the latter must be most exquisitely corrected, as regards their spherical and chromatic aberration, or else everything comes to the eye in a distorted state. On this account the Huyghenian ocular is not fit to be used, since it lacks just what we need here. I have for several years past asserted that the next step in the increase of the magnifying powers of the microscope would be accomplished by the construction of a new form of eye-piece, which would augment the image formed by the objective to an almost unlimited extent. At last I am happy to find my prediction verified, in the most practical manner, by the 'orthoscopic ocular' invented by Spencer. With such a range of powers, then, there is hardly any body of moderate transparency but what may be minutely investigated to its very core. If a subject is too thick for the short working distance of the higher powers, a lower objective may be used, and the higher oculars applied to make up the deficiency. Of course I do not mean to say that a certain amplification obtained by a low objective and a high orthoscopic ocular is fully as good as the same afforded by a higher objective; but in case the latter cannot reach a certain internal structure, the former can be used, with very little appreciable difference, and is by far better than the usual methods employed in such cases, such as pressure or dissections and the isolation of the organ to be investigated.

"I have not had an opportunity to make frequent use of the 'orthoscopic eye-piece'; but Mr. Spencer has furnished me with another form of ocular, the 'solid eye-piece,' invented by his pupil, Mr. Tolls. This, Mr. Spencer tells me, so closely approaches the 'orthoscopic eye-piece' in quality, that none but a very experienced eye could detect the difference, and the former excels the latter in the admission of light, because it has fewer reflecting surfaces. With this ocular and a quarter-inch objective I have run the magnifying power up to two thousand diameters, with wonderful results, which fully justify me in saying all that I have in regard to the study of thick tissues with low powers having wide angles of aperture.*

" I will take a young fish as an example to illustrate the remarkable efficiency of the flat field. In a view from above, one may see no less than six or seven different layers or sets of organs resting one over the other; first the skin and the muscular layer, next the vertebræ, within these the spinal marrow, and below the latter the chorda dorsalis, and close to this the dorsal artery, then the intestines and their appendages; and yet every one of these may be plunged through and totally ignored, on account of the peculiar properties of the flat field, and the last, the intestines, minutely inspected, not only cell by cell, but each cell may be studied, in every particular of detail, as if it were isolated. And so may any set of organs be treated, whether situated above or below in the animal. With such means at hand, as long as cells may be seen with a very moderate light, it is utterly preposterous to trust what may be worked out by separating these organs from the animal, piecemeal. When intact, every cell may be measured, not only transversely, but also with the greatest nicety in a perpendicular direction, by the micrometer screw, which works the fine adjustment of the objective; every cell, indeed, may be treated as if it were a separate body; but who would warrant to measure, for instance, the size of the cells of a nerve after it had been removed from its natural position, and with more or less inevitable distortion? Unfortunately, investigators have been compelled to do this too often, up to this very day; but now I hope for much better and more trustworthy results.

" In Embryology, how beautifully this almost transcendental definition of the objective applies! All the cells of an embryo of a certain age may be represented by a circle, with a smaller circle within known as the mesoblast (nucleus). At successively later ages we find the

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* In this connection I would urge upon students the necessity of avoiding the higher powers of the microscope in the commencement of their studies. When they have learned to use the lower objectives, it will be a much easier matter to master the higher ones. Students usually suppose that they can see everything with the higher powers, whereas they are greatly mistaken; as much as one would be who should make a minute inspection of the stones of some great architectural pile, and then think he had obtained a proper conception of its magnificent plan and glorious proportions.

cells of the nerves, for instance, simply oval, as the first step to élongation; next they are in rows; then the ends in contact are without walls, so that each cell opens into its neighbor; and finally, all trace of the separate cell-wall is lost in the straight sides of the nerve tubule, with nothing but the mesoblasts to indicate the original position of the cells. In the chorda dorsalis, intestines, vertebræ, muscles, &c., similar and apparently gradual changes have been observed; but each step, in most instances, was investigated isolately from the previous one, and the intervening space bridged over by the process of inductive reasoning alone. This is not enough; now we know that every second of the life of a cell, or series of cells, may be traced most minutely, minute by minute, hour by hour, and day by day. Day and night, watches have been kept by observers in other departments of science, and why may not the naturalist do so? In some cases a very extensive series of changes may be observed in a short time; for instance, in the embryo of the common Bream (*Pomotis vulgaris*), which Professor Wyman has observed to pass from the segmenting of the yolk to hatching in the space of about forty hours. It is not possible, in any way, to trace the gradual metamorphoses of cells and organs, except upon the living body; otherwise, every observation is a record of a detached fact, and no more; every bit of an organ is subjected to all sorts of manipulations to bring out what too often is not there according to the laws of the living being. Reagents at one time, and pressure at another, reveal, not the truths of nature, but our carelessness and presumption. I have in mind a remarkable instance of the evils of the almost monomaniacal habit of using pressure whilst investigating tissues. A celebrated physiologist, in all probability, missed the most fortunate chance of discovering the key to the whole history of the mode of origin of the embryo from the yolk-cells, simply by using a bit of thin glass to cover the object on his glass slide. Just before the segmentation of the yolk, the full-grown yolk-cells of birds, turtles, if not all scaly reptiles, and sharks, are very thin-walled, hyaline, globular vesicles, each one of which contains a more or less darkened mesoblast, and within the latter are a certain number of entoblasts (nucleoli). Now under the least pressure, the cell-wall bursts quickly, and the mesoblast becomes fissured or wrinkled. In this condition the mesoblast was figured and described as the yolk-cell proper, by no less careful an observer than Johannes Müller. Now in the turtle, at least, the mesoblast undergoes self-division until there are innumerable mesoblasts in the parent cells; and after the latter have congregated to form the different layers of the incipient organs of the embryo, and burst, the former unite side by side, and thus become the original cells of the young tissues.

"I feel that I cannot urge too strongly the utmost necessity of studying living beings as nearly in a state of nature as is possible; to attempt this by all available means and contrivances, and, above all, patiently, not begrudging the time, because more numerous observations might be obtained by making a piecemeal and hurried show of dismembered Nature.

"It would certainly be more profitable, as far as living beings are concerned, if the whole world of science should, for a while at least, investigate exclusively the few transparent animals that may be obtained, than work over the numberless opaque ones which require the dissecting-knife. The first having been investigated, the knowledge of them would assist us the better to interpret the features and relations of the tissues, which we would be obliged to study in a disconnected state, just as fossils are recognized and restored by the comparative anatomist after a careful research among living models.

"I have been anxious to present this communication, and to have it recorded, because certain microscopists, who are considered as high authority both in England and in this country, have attempted to depreciate the value of the flat field and wide angle of aperture in the study of living objects. This is a little remarkable, since it comes from a country where, until recently, the most finished microscopes of this kind were made, and where they are now to be found in large numbers. I will read a few passages, which may be found on page 196 of Dr. Carpenter's work on the microscope. He says: 'The author feels it the more important that he should express himself clearly and strongly on this subject, as there is a great tendency at present, both among amateur microscopists and among opticians, to look at the attainment of that "resolving power" which is given by angular aperture, as the one thing needful; those other attributes which are of far more importance in almost every kind of scientific investigation, being comparatively little thought of; and he therefore ventures here to repeat the remarks he made upon this subject, in his recent Presidential Address to the Microscopical Society, of the correctness of which he has been since assured, by the approval of many of those who have most successfully employed the microscope in physiological investigations: "The superiority in resolving power possessed by object-glasses of large angular aperture, is obtained at the expense of other advantages. For even granting that there is no sacrifice of that most important element, *defining* power (which can only be secured, with a very wide angle, by the utmost perfection in all the corrections), yet the adequate performance of such a lens can only be secured by the greatest exactness in the adjustments. Only that portion of the object which is *precisely* in focus can be seen with an approach to distinctness, everything that is in the least degree out of it being imbedded (so to speak) in a thick fog; it is requisite, too, that the adjustment for the thickness of the glass that covers the object, should exactly neutralize the effect of its refraction; and the arrangement of the mirror and condenser must be such as to give to the object the best possible illumination. If there be any failure in these conditions, the performance of a lens of very wide angular aperture is *very much inferior* to that of a lens of moderate aperture; and, except in very experienced hands, this is likely to be generally the case. Now to the working microscopist, unless he be studying the particular classes of objects which expressly require this condition, it is a source of great inconvenience and loss of time to be obliged to be continually making these adjustments; and a lens, which, when adjusted for a thickness of glass of $\frac{1}{100}''$, will perform without much sensible deterioration with a thickness either of $\frac{1}{80}''$ or of $\frac{1}{120}''$, is practically the best for all ordinary purposes. Moreover, a lens of moderate aperture has this very great advantage, that the parts of the object which are less perfectly in focus can be much better seen; and therefore that the relation of that which is most distinctly discerned, to all the rest of the object, is rendered far more apparent. Let me remind you, further, that almost all the great achievements of microscopic research have been made by the instrumentality of such objectives as I am recommending. There can be no question about the large proportion of the results which Continental microscopists may claim, in nearly all departments of minute anatomical, physiological, botanical, or zoölogical investigations, since the introduction of this invaluable auxiliary; and it is well known that the great majority of their instruments are of extremely simple construction, and that their objectives are generally of very moderate angular aperture. Moreover, if we look at the date of some of the principal contributions which this country has furnished to the common stock, — such as the 'Odontography' of Professor Owen, the 'Researches into the Structure of Shell' carried out by Mr. Bowerbank and myself, the 'Physiological Anatomy' of Messrs. Todd and Bowman, the first volume of the 'Histological Catalogue' by Professor Quekett, and the 'British Desmideæ' of Mr. Ralfs, — we find sure reason to conclude that these researches *must* have been made with the instrumentality of lenses, which would in the present day be regarded as of very limited capacity. — I hope that, in these remarks, I shall not be understood as in any way desirous to damp the zeal of those who are applying themselves to the perfectionizing of achromatic objectives. I regard it as a fortunate thing for the progress of science, that there are individuals whose tastes lead them to the adoption of this pursuit; who stimulate our instrument-makers to go on from one range to another, until they have conquered the difficulties which previously baffled them; and then apply themselves to find out some new tests, which shall offer a fresh difficulty to be overcome. But it is not the *only*, nor can I regard it as the *chief* work of the microscope, to resolve the markings upon the Diatomaceæ, or tests of the like difficulty; and although I *should* consider this as the highest object of ambition to our makers, if the performances of such lenses with test-objects were any fair measure of their general utility, yet as I think that I have demonstrated that the very conditions of their construction render them inferior in this respect for the purposes of ordinary microscopic research, I would much rather hold out the reward of high appreciation (*we* have no other to give) to him who should produce the *best working microscope*, adapted to all ordinary requirements, *at the lowest cost*."'

"Notwithstanding the approval of those, as Dr. Carpenter says, 'who have most successfully employed the microscope in physiological investigations,' I do not hesitate for a moment to declare, that nothing could be more pernicious to the best interests of science than these remarks. It is unfortunate that such mistaken views should be displayed on this subject, where so great confidence has been placed, — by one, too, whose elementary works on physiology have raised the belief, among many, that he is perfectly conversant with those very tissues which require the nicest and most rigid microscopical investigation.

"The illustrations which I have given, of the great value of highly corrected lenses in the study of minute structures, are sufficient, I think, to refute these views; but I would like to say a few words more in conclusion, especially in reference to the general relations of microscopical investigations to other departments of natural history.

"To say that objectives with a wide angle of aperture and a flat field, are needed for only a few bodies, such as test objects, like the Diatomaceæ and other known difficult subjects, is to ignore the whole great department of histology, and by that to refuse physiology one of the most important aids; in fact, an aid which, with the help of better microscopes, in future, is likely to take the lead in the determination of the laws of animal and vegetable life. I am well aware that the study of histology has been pursued with the ordinary instruments, of the German pattern, in a great measure; but knowing what these have done both in Europe and in this country, and having discovered, by a few glimpses, how much more, and how much better, we might have done, had we possessed one of these highly finished instruments, I can confidently assert, that it is a grave error to tell opticians that they had better devote themselves more particularly to the improvement of the ordinary instruments, and let their transcendental corrections of widely gaping objectives serve in the mean while as playthings for curious amateurs.

"But it is a still more serious mistake to say to students, that an instrument which performs under a variety of circumstances 'without much sensible deterioration' is practically the best for all ordinary purposes.

"So thought Ehrenberg, and yet we all now know what curious mistakes he made. Embryology, too, comes under this proscription; for any one who has attempted to trace the development of animals, especially the lower forms of life, must know that it is impossible to separate the study of their cellular structure from the investigation of their organs.

"I cannot more fittingly conclude this communication, than by quoting, by Mr. Spencer's leave, a portion of a recent letter of his to me. He says: 'It seems to me that there is every reason to hope much from the earnest application of high powers with large angles. So blind and inveterate has been the prejudice in favor of low powers and small angles, in histology, that younger and less prejudiced microscopists have a comparatively untrodden path before them. Every day's thought convinces me more and more deeply of the radical mistake that has been made in this direction. I have recently been making some observations and experiments with low angles on certain well-known structures, and have in several instances been struck with a blank astonishment at the utterly false, though apparently reliable, results obtained. It happens, too, that the physical and optical characters of those tissues which, oftener than any others, are the subjects of your study, are precisely such as will lead to the most frequent errors; and if you do not find that many a blunder has been made in their study, heretofore, I shall be greatly surprised.' "

Four hundred and sixtieth meeting.

February 8, 1859. — ADJOURNED STATED MEETING.

The Academy met at the house of Hon. Josiah Quincy.

The PRESIDENT in the chair.

The Corresponding Secretary read the following letters, viz.: from Der Kongelige Danske Videnskabernes Selskab, Copenhagen, July 1, 1858; K. K. Geologische Reichsanstalt, Vienna, November 30, 1857; and the Zoölogisch-Botanischer Verein, Vienna, March 15, 1858, acknowledging the receipt of the publications of the Academy; — from Der Kongelige Danske Videnskabernes Selskab, July 1, 1858; Société Imperiale des Naturalistes de Moscou, June 17, 1858; Die Königlich Sächsische Gesellschaft der Wissenschaften, Leipzig, April 28 and July 18, 1858; and Die K. K. Geologische Reichsanstalt, Vienna, January 10, 1857, presenting their various publications.

The recent decease of a distinguished Fellow, William H. Prescott, the historian, was noticed in the following remarks.

Rev. George E. Ellis said: —

" I rise, Mr. President, at your request, to engage the attention of the Academy for a few moments in one of those sad but grateful offices of respectful commemoration, which something better than mere usage exacts of the living, when they miss from their pleasant fellowship an honored associate. The late Mr. William Hickling Prescott was a